

In re Patent Application of:  
**SHIEH ET AL.**  
Serial No. 10/715,165  
Filed: **November 17, 2003**  
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IN THE CLAIMS

1. (original) A vertical cavity surface emitting laser  
comprising:

a first mirror region forming a first distributed  
Bragg reflector;

a first cladding region positioned on the first  
mirror region;

an active region positioned on the first cladding  
region;

a second cladding region positioned on the active  
region and including a high electrical resistance implanted  
region positioned to define a current path;

a second mirror region positioned on the second  
cladding region;

a current spreading region positioned on the second  
mirror region;

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a first electrical contact in electrical communication with the current spreading region and a second electrical contact positioned to conduct electrical current in circuit with the first electrical contact through the current path;

the current spreading region and the second mirror region cooperating to produce substantially uniform current distribution in the current path; and

a third mirror region positioned on the current spreading region, the second and third mirror regions cooperating to provide a complete distributed Bragg reflector.

2. (original) A vertical cavity surface emitting laser as claimed in claim 1 wherein the first mirror region, the first cladding region, the active region, the second cladding region, the second mirror region, and the current spreading region include epitaxial semiconductor layers.

3. (original) A vertical cavity surface emitting laser as claimed in claim 1 wherein the high electrical resistance implanted region includes ion implanted material.

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4. (original) A vertical cavity surface emitting laser as claimed in claim 1 wherein the second mirror region includes from one to five pairs of alternate mirror layers of a first material with a first index of refraction and a second material with a second index of refraction.
5. (original) A vertical cavity surface emitting laser as claimed in claim 1 wherein the current spreading region includes at least one highly doped semiconductor layer.
6. (original) A vertical cavity surface emitting laser as claimed in claim 1 wherein the third mirror region includes a plurality of pairs of one of alternate semiconductor layers and alternate dielectric layers.
7. (original) A vertical cavity surface emitting laser as claimed in claim 1 further including an index guide formed in the current spreading region.
8. (original) A vertical cavity surface emitting laser as claimed in claim 1 further including a notch formed in the first mirror region to limit a diameter to approximately a primary mode of operation.

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9. (original) A vertical cavity surface emitting laser as claimed in claim 1 further including a tunneling junction.

10. A vertical cavity surface emitting laser comprising:

a first mirror region forming a first distributed Bragg reflector;

a first cladding region positioned on the first mirror region;

an active region positioned on the first cladding region;

a second cladding region positioned on the active region and including a high electrical resistance ion implanted region positioned to define a current path;

a second mirror region positioned on the second cladding region including from one to five pairs of alternate mirror layers of a first semiconductor material with a first index of refraction and a second semiconductor material with a second index of refraction;

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a current spreading region including a heavily doped semiconductor layer positioned on the second mirror region;

an index guide formed in the current spreading region, the index guide defining a lasing cavity;

a first electrical contact in electrical communication with the current spreading region and a second electrical contact positioned to conduct electrical current in circuit with the first electrical contact through the current path;

the current spreading region and the second mirror region cooperating to produce substantially uniform current distribution in the current path; and

a third mirror region positioned on the current spreading region, the second and third mirror regions cooperating to provide a complete distributed Bragg reflector.

11. (original) A vertical cavity surface emitting laser as claimed in claim 10 wherein the third mirror region includes a plurality of pairs of one of alternate semiconductor layers and alternate dielectric layers.

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Claims 12 to 26 (cancelled)